

11. (Unamended) An optical apparatus comprising:

means for forming an image to be observed; and

an ocular optical system for leading said image to an observer's eyeball,

said ocular optical system including, in order from said image side, a third surface which forms an entrance surface, a first surface which forms both a reflecting surface and an exit surface, and a second surface which forms a reflecting surface, said first to third surfaces being integrally formed with a medium disposed therebetween,

wherein said means for forming an image is an image display device for forming an image for observation,

said device being disposed at a position facing said third surface,

said optical apparatus further comprising means for fitting both said device and said ocular optical system to an observer's head,

wherein at least said first surface in said ocular optical system is formed from a rotationally asymmetric curved surface so as to correct aberrations produced by a decentered surface having an optical action.

12. (Unamended) An optical apparatus according to claim 11, a combination of said device and said ocular optical system being provided for each of observer's left and right eyeballs so as to lead an image to each of the observer's left and right eyeballs.

13. (Unamended) An optical apparatus according to claim 12, further comprising:

a see-through optical system disposed in the vicinity of the second surface of said ocular optical system to transmit a bundle of light rays from an outside world and lead it to the second surface of said ocular optical system; and

a shutter provided at a side of said see-through optical system which is closer to the outside world, said shutter allowing light to be selectively transmitted or shut off.

DI 14. (Unamended) An optical apparatus according to claim 13, wherein a surface of said see-through optical system on which outside world light is incident has a configuration approximated to the first surface of said ocular optical system, and a surface of said see-through optical system from which outside world light emanates has a configuration approximated to the second surface of said ocular optical system.

15. (Unamended) An optical apparatus according to claim 11, further comprising:

a see-through optical system disposed in the vicinity of the second surface of said ocular optical system to transmit a bundle of light rays from an outside world and lead it to the second surface of said ocular optical system; and

a shutter provided at a side of said see-through optical system which is closer to the outside world, said shutter allowing light to be selectively transmitted or shut off.

16. (Unamended) An optical apparatus according to claim 15, wherein a surface of said see-through optical system on which outside world light is incident has a configuration approximated to the first surface of said ocular optical system, and a surface of said see-through optical system from which outside world light emanates has a configuration approximated to the second surface of said ocular optical system.

DI 17. (Unamended) An optical apparatus comprising:
a device for displaying an image; and
an ocular optical system for projecting an image formed by said device and for leading the image to an observer's eyeball,
said ocular optical system comprising at least first, second and third surfaces, in which a space defined by said surfaces is filled with a medium,
said device being disposed at a position facing said third surface,
said at least first, second and third surfaces including, in order from the observer's eyeball side toward said device, said first surface which serves as both a refracting surface and an internally reflecting surface, said second surface which serves as a reflecting surface of positive power and which faces said first surface and is decentered or tilted with respect to an observer's visual axis, and said third surface which serves as a refracting surface closest to said device,
wherein at least said first surface in said ocular optical system is formed from a rotationally asymmetric curved surface so as to correct aberrations produced by a decentered surface having an optical action.

18. (Unamended) An optical apparatus according to claim 17, a combination of said device and said ocular optical system being provided for each of observer's left and right eyeballs so as to lead an image to each of the observer's left and right eyeballs.

19. (Unamended) An optical apparatus according to claim 18, wherein internal reflection from said first surface is total reflection.

20. (Unamended) An optical apparatus according to claim 17, wherein internal reflection from said first surface is total reflection.

21. (Unamended) An optical apparatus according to any one of claims 17 to 20, wherein any one of said first, second and third surfaces is a decentered aspherical surface.

22. (Unamended) An optical apparatus according to claim 21, wherein any one of said first, second and third surfaces is an anamorphic surface.

23. (Unamended) An optical apparatus comprising:
an image display device; and
an ocular optical system for projecting an image formed by said image display device and for leading the image to an observer's eyeball,

said ocular optical system including a decentered optical element comprising at least first, second, and third surfaces, in which a space defined by said surfaces is filled with a medium, said surfaces including, from said observer's eyeball side toward said image display device, said first surface serving as both a refracting surface and a totally reflecting surface, said second surface serving as a reflecting surface of positive power which faces said first surface and is decentered or tilted with respect to an observer's visual axis, and said third surface serving as a refracting surface closest to said image display device,

said image display device being disposed at a position facing said third surface,

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said ocular optical system further including at least one optical surface having refracting action, said decentered optical element and said at least one optical surface being disposed in an optical path which extends from said image display device to said observer's eyeball,

wherein at least said first surface in said ocular optical system is formed from a rotationally asymmetric curved surface so as to correct aberrations produced by a decentered surface having an optical action.

24. (Unamended) An optical apparatus according to claim 23, a combination of said device and said ocular optical system being provided for each of observer's left and right eyeballs so as to lead an image to each of the observer's left and right eyeballs.

25. (Unamended) An optical apparatus according to claim 24, wherein said at least one optical surface is disposed between said observer's eyeball and the first surface of said decentered optical element.

26. (Unamended) An optical apparatus according to claim 24, wherein said at least one optical surface is disposed between the third surface of said decentered optical element and said image display device.

27. (Unamended) An optical apparatus according to claim 24, wherein said at least one optical surface is decentered with respect to said observer's visual axis.

DI 28. (Unamended) An optical apparatus according to claim 23, wherein said at least one optical surface is disposed between said observer's eyeball and the first surface of said decentered optical element.

29. (Unamended) An optical apparatus according to claim 23, wherein said at least one optical surface is disposed between the third surface of said decentered optical element and said image display device.

30. (Unamended) An optical apparatus according to claim 23, wherein said at least one optical surface is decentered with respect to said observer's visual axis.

31. (Unamended) An optical apparatus according to any one of claims 23 to 30, wherein said at least one optical surface and said decentered optical element form an air lens.

32. (Unamended) An optical apparatus according to any one of claims 17 to 20 and 23 to 30, further comprising means for positioning both said device and said ocular optical system with respect to an observer's head.

33. (Unamended) An optical apparatus according to any one of claims 17 to 20 and 23 to 30, further comprising means for supporting both said device and said ocular optical system with respect to an observer's head so that said optical apparatus can be fitted to said observer's head.

DI 34. (Unamended) An optical apparatus according to any one of claims 17, 20, 23, and 28 to 30, further comprising means for supporting a pair of said optical apparatuses at a predetermined distance.

35. (Unamended) An optical apparatus according to any one of claims 18, 19, and 24 to 27, further comprising means for supporting said combinations at a predetermined distance.

36. (Unamended) An optical apparatus according to any one of claims 17 to 20 and 23 to 30, wherein said ocular optical system is used as an imaging optical system.

37. (Unamended) An optical apparatus according to any one of Claims 11 through 16, wherein said medium is acrylic resin or glass.

38. (Unamended) An optical apparatus according to any one of Claims 17 through 20, wherein said medium is acrylic resin or glass.

39. (Unamended) An optical apparatus according to Claim 21, wherein said medium is acrylic resin or glass.

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40. (Unamended) An optical apparatus according to Claim 22, wherein said medium is acrylic resin or glass.

41. (Unamended) An optical apparatus according to any of Claims 23 through 30, wherein said medium is acrylic resin or glass.

42. (Unamended) An optical apparatus according to Claim 31, wherein said medium is acrylic resin or glass.

43. (Unamended) An optical apparatus according to Claim 32, wherein said medium is acrylic resin or glass.

44. (Unamended) An optical apparatus according to Claim 33, wherein said medium is acrylic resin or glass.

45. (Unamended) An optical apparatus according to Claim 34, wherein said medium is acrylic resin or glass.

46. (Unamended) An optical apparatus according to Claim 35, wherein said medium is acrylic resin or glass.

47. (Unamended) An optical apparatus according to Claim 36, wherein said medium is acrylic resin or glass.

48. (Unamended) An optical apparatus comprising:
an image-forming member that forms an image to be observed, and
an ocular optical system provided to lead said image to an eyeball of an observer,

wherein said ocular optical system includes, in order from an image side thereof, a third surface that forms an entrance surface, a first surface that forms both a reflecting surface and an exit surface, and a second surface that forms a reflecting surface, said first, second and third surfaces being integrally formed to face each other across a medium, and

wherein at least one of said first, second and third surfaces is formed from a rotationally asymmetric curved surface that corrects aberration produced by a decentered surface.

49. (Unamended) An optical apparatus according to claim 48, further comprising:

an optical member located between said image-forming member and the eyeball of said observer, said optical member consisting of a material differing in dispersion from a material of said medium.

DI 50. (Unamended) An optical apparatus according to claim 49, further comprising:

a fitting member fitted to a head of said observer to retain said image-forming member, said ocular optical system and said optical member being in front of said observer.

51. (Unamended) An optical apparatus according to claim 49 or 50, wherein said optical member is placed between the first surface of said ocular optical system and the eyeball of said observer.

52. (Unamended) An optical apparatus according to claim 51, wherein said optical member comprises at least one optical surface having refracting action.

53. (Unamended) An optical apparatus according to claim 49 or 50, wherein said optical member is located between the third surface of said ocular optical system and an image display device.

54. (Unamended) An optical apparatus according to claim 53, wherein said optical member comprises at least one optical surface having refracting action.

55. (Unamended) An optical apparatus according to claim 49 or 50, wherein reflection at the first surface of said ocular optical system is total reflection.

D1 56. (Unamended) An optical apparatus according to claim 49 or 50, wherein the second surface of said ocular optical system is a reflecting surface arranged to give a positive power to a light beam by reflection.

57. (Unamended) An optical apparatus according to claim 49 or 50, wherein the first, second and third surfaces of said ocular optical system are each formed from a rotationally asymmetric curved surface that corrects aberration due to decentration.

--58. (New) In an optical apparatus comprising an image-forming member that forms an image to be observed, and an ocular optical system provided to lead said image to an eyeball of an observer,

D2 the improvement wherein said ocular optical system includes, in order from an image side thereof, a third surface that forms an entrance surface, a first surface that forms both a reflecting surface and an exit surface, and a second surface that forms a reflecting surface, said first, second, and third surfaces being integrally formed to face each other across a medium,

at least one of said first, second, and third surfaces is formed from a rotationally asymmetric curved surface that corrects aberration produced by a decentered surface, and

an optical member is placed between said ocular optical system and the eyeball of said observer, said optical member transmitting light exiting from said ocular optical system.

59. (New) An optical apparatus according to claim 58, further comprising:
a fitting member fitted to a head of said observer to retain said image-forming member, said ocular optical system and said optical member in front of said observer.

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60. (New) An optical apparatus according to claim 58 or 59,
wherein said optical member includes an entrance surface and an exit surface, which face each other across a medium, said entrance surface being placed on a side of said optical member closer to said ocular optical system, said exit surface being placed on a side of said optical member closer to the eyeball of said observer.

61. (New) An optical apparatus according to claim 58 or 59,
wherein reflection at the first surface of said ocular optical system is total reflection.

62. (New) An optical apparatus according to claim 58 or 59,
wherein the second surface of said ocular optical system is a reflecting surface arranged to give a positive power to a light beam by reflection.

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63. (New) An optical apparatus according to claim 58 or 59,
wherein the first, second, and third surfaces of said ocular optical system are
each formed from a rotationally asymmetric curved surface that corrects aberration due to
decentration.--

REMARKS

Favorable reconsideration of the subject application is respectfully solicited.

Claims 11 through 63 are pending, with Claims 11, 17, 23, 48, and 58 being
independent. Claims 58 through 63 have been added.

STATEMENT UNDER 37 C.F.R. § 1.607(c)

In accordance with the provisions of 37 C.F.R. § 1.607(c), the Examiner is
respectfully advised that newly added Claims 58 through 63 have been copied in modified form
from Claims 1 through 3 and 9 through 11, respectively, of U.S. Patent No. 6,317,267 B1
(“Takahashi ‘267”) to Koichi Takahashi.

CONCLUSION

In keeping with the Examiner’s suggestion, Applicants are deferring filing a
Supplement to Request for Interference at this time, and respectfully request that at such time
deemed appropriate by the Examiner, the Examiner contact Applicants’ undersigned
representative to discuss the inclusion of Takahashi ‘267 and the newly-added claims in the
interference.